Hydrogen, Fuel Cells, & Infrastructure Technologies Program

Vision for a Secure Energy Future

Powering the Nation

Over the next 20 years, U.S. energy *consumption* is expected to grow by 30 percent, while domestic energy *production* is expected to grow by only 25 percent. As consumption outpaces production, our dependence on imported petroleum threatens to increase, endangering our economy and standard of living, and compromising our national energy security.

Fortunately, another promising scenario for our energy future is emerging—one that relies on hydrogen-powered fuel cell systems to produce electricity for our vehicles, homes and even large buildings, using abundant domestic resources. Through its Hydrogen, Fuel Cells, and Infrastructure Technologies Program, the U.S. Department of Energy furthers the technologies vital to a hydrogen energy future. In his recent State of the Union address, President Bush announced a groundbreaking plan to transform our nation's energy future from one dependent on foreign petroleum to one that utilizes the most abundant element in the universe—hydrogen. The concept underlying this initiative is simple yet profound—create automotive operating systems that run on hydrogen instead of gasoline. When hydrogen is used to power fuel cell vehicles, it will do so with more than twice the efficiency of today's gasoline engines—and none of today's harmful emissions.

The mission of the Program is to research, develop, and validate fuel cells and hydrogen production, delivery, and storage technologies for transportation and stationary applications. Through partnerships with industry, academia, and national laboratories, and in coordination with FreedomCAR and other DOE programs, the Program strives to overcome technical barriers, address safety concerns and develop model codes and standards, and educate key stakeholders whose acceptance of these new technologies will determine their success in the marketplace.

With the potential to provide virtually limitless, safe, reliable, and domestically-produced energy that is free from harmful emissions, hydrogen and fuel cell technologies may not only satisfy our growing energy needs, but also help protect our health, environment, and prospects for economic strength.

Areas of Research

The Program's research and development efforts are focused in three areas:

- **Hydrogen production.** To enable affordable and efficient hydrogen production, the Program is researching ways to reduce the cost of producing hydrogen from natural gas and

The Hydrogen Vision

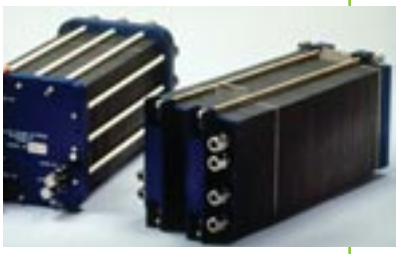
Hydrogen is America's clean energy choice. Hydrogen is flexible, affordable, safe, domestically produced, and used in all sectors of the economy and in all regions of the country.

Realizing this vision will require fundamental changes in the way our nation produces and uses energy. DOE and its partners are spearheading essential R&D to reduce the cost of hydrogen production, transportation, and storage, and improve performance, reliability, and durability of fuel cell systems.

conventional liquid fuels, and developing new technologies for hydrogen separation and purification from high-pressure, high-temperature synthetic gas. Research also addresses hydrogen production from renewable sources, including water electrolysis and photolytic technologies, as well as thermochemical technologies for generating hydrogen from biomass, and water-splitting using high-temperature heat sources.

- **Hydrogen transportation and storage.** Once the hydrogen is produced, it must be transported and stored for future use. The Program focuses on defining a cost-effective hydrogen fuel delivery infrastructure for transportation and stationary applications. In close coordination with DOE's FreedomCAR program, the Program also works to develop and demonstrate safe, compact, low-cost hydrogen storage systems that will provide greater than 300-miles vehicle range. Technologies for bulk storage in commercial and industrial applications are also included in research and development efforts.

- **Fuel cells.** Hydrogen can be used in fuel cells to power vehicles and generate heat and electricity for buildings. But significant research and development are needed to reduce costs and improve performance to meet consumer needs. Stationary fuel cell system research is focused on developing an efficient and durable distributed generation fuel cell system that uses natural gas or propane. For transportation, the Program works closely with FreedomCAR partners to develop an efficient and durable fuel cell system that uses direct hydrogen,



Hydrogen is the simplest and most abundant element on earth. Although it never occurs by itself in nature, it can be produced from a variety of different sources. Fuel cells use the chemical energy of hydrogen and oxygen from air to produce electricity—without combustion or pollution.

as well as one that uses an on-board reformer to produce hydrogen from hydrocarbon or alcohol-based fuels—and still meet emissions, cost, and performance expectations.

Technology Validation, Safety, Codes and Standards, and Education

Successful commercialization of any new technology requires real-world testing and data collection. The Program works with business, industry, and government partners to demonstrate and validate hydrogen and fuel cell systems in real-world operating conditions. Demonstrating the safe use of hydrogen is essential to this effort. The Program is collaborating with industry on a comprehensive safety plan, and facilitating the adoption of model codes and equipment standards, which will simplify the transition to hydrogen fuel use worldwide. Education is also critical to market acceptance. Through a coordinated and comprehensive education campaign that includes training programs for state and local officials and potential end-users, as well as materials for teachers, students, and the general public, the Program fosters the understanding of hydrogen and fuel cell systems needed to achieve the hydrogen vision.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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